Fluctuations and Phase Transitions in Superconductors

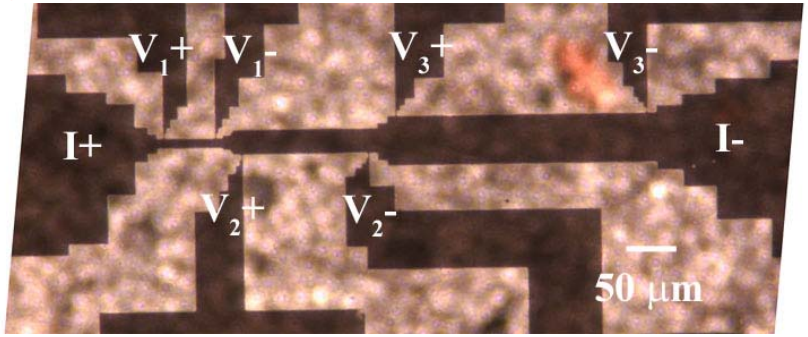
C. J. Lobb and S. M. Anlage, Center for Superconductivity Research, University of Maryland

DMR-0302596

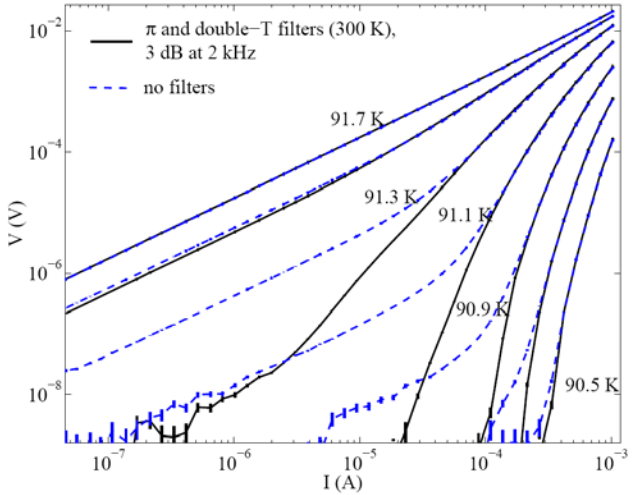
Understanding the phase transition between a normal metal and a superconductor has been a goal of researchers since soon after the high-temperature superconductors were discovered. We have been studying various effects which can obscure or destroy the phase transition, including: magnetic field, current noise, and finite-size effects. We hope our work will provide insight into how superconductors become superconducting.

PRL **87**, 067001 (2001)

PRB **69**, 214524 (2004)



YBCO film patterned for multiple simultaneous 4-probe current vs. voltage measurements.



Current-voltage (IV) curves filtered to remove noise (black) loose their resistance at 91.1 K, whereas the phase transition is destroyed in unfiltered measurements (blue).

Fluctuations and Phase Transitions in Superconductors

C. J. Lobb and S. M. Anlage, Center for Superconductivity Research, University of Maryland

DMR-0302596

Education:

Two undergraduates (Richard Ott and Monica Lilly), three graduate students (Matthew C. Sullivan, Su Li, and Hua Xu) and one post-doc (Douglas R. Strachan) contributed to this work. Richard Ott is currently a graduate fellow at M.I.T. and Monica Lilly is currently a senior writing her honors thesis at the University of Maryland. Matthew C. Sullivan received his Ph.D. in 2004 and is now employed at Intel Corporation, and Douglas Strachan is a working for A. T. Johnson at the University of Pennsylvania. Su Li and Hua Xu are still members of the PI's group and are performing related experiments.

Societal Impact:

High-temperature superconductors have potential uses in digital electronics, communications, magnets, and electrical power systems. Our work elucidates the phase transition and loss mechanisms in these materials, and may lead to novel applications, as well as to new, higher-temperature superconductors.